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09/898,469	07/05/2001	Gang Paul Chen	ChenInterleave	8152

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EXAMINER	
JUBA JR, JOHN	

ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 12/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/898,469	CHEN ET AL.	
	Examiner	Art Unit	
	John Juba	2872	MW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4,5,7,10,13-16,18-34,36-65 and 67-113* is/are pending in the application.

4a) Of the above claim(s) *71-113* is/are withdrawn from consideration.

5)☒ Claim(s) *1,2,4,5,7,13-16,34,36-41,65 and 67-70* is/are allowed.

6)☒ Claim(s) *10,18-26,29,31,42,43,46-50,58 and 60-64* is/are rejected.

7)☒ Claim(s) *27,28,30,32,33,44,45,51-57 and 59* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

The drawings are objected to because of the following informalities:

The function of beam splitter (72) and the beam splitter following wave plate (75) is believed to be mis-illustrated in Figure 2. See attached marked-up copy.

The lead line on the first state of polarization diagram in Figure 3 is believed to be misplaced. An appropriate location near beam splitter (35) is indicated in the attached marked-up copy of Figure 3.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 18 and 19 are objected to for the following informalities. Appropriated correction is required. In claim 18, (line 4), there is no antecedent basis for the beam splitters as particularly being polarization beam splitter. Claim 19 inherits the same deficiency through its dependency.

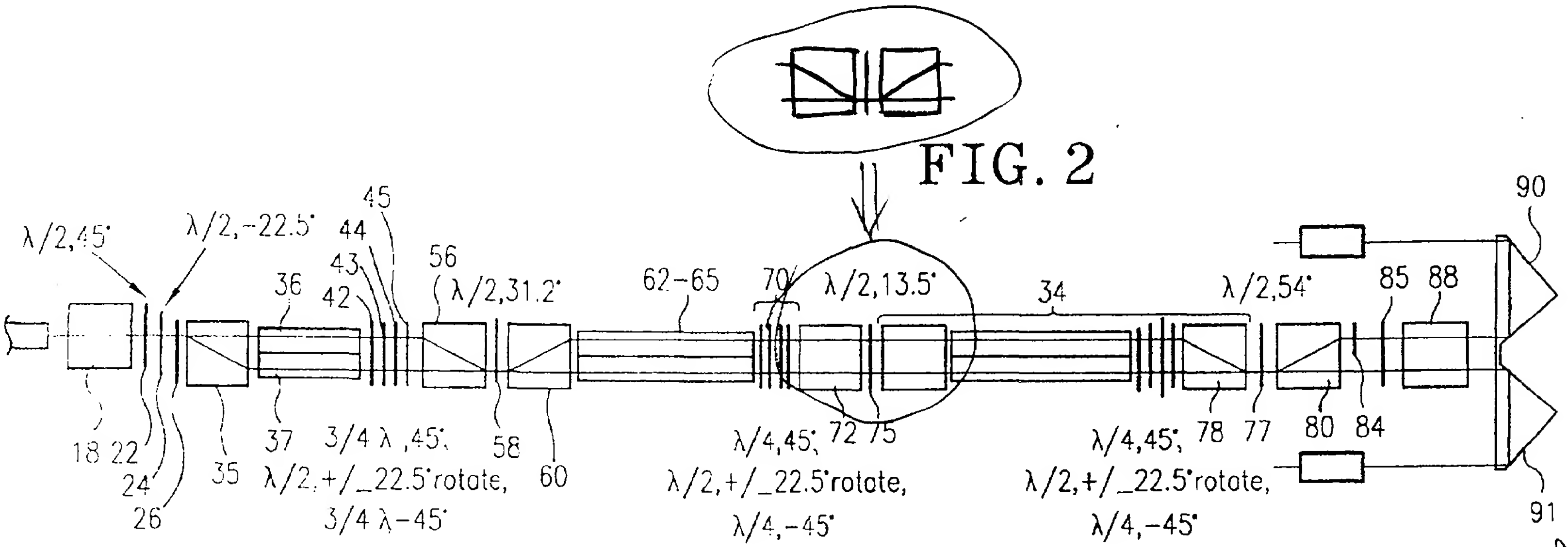

λ/2,45°
λ/2,-22.5°
45
44
43
42
36
56
λ/2,31.2°
62-65
70
λ/2,13.5°
34
λ/2,54°
85
88
90
18
22
24
26
35
37
3/4 λ ,45°,
λ/2,+/_22.5°rotate,
3/4 λ-45°
58
60
λ/4,45°,
72
75
λ/2,+/_22.5°rotate,
λ/4,-45°
λ/4,45°,
78
77
80
84
λ/2,+/_22.5°rotate,
λ/4,-45°
91

FIG. 2

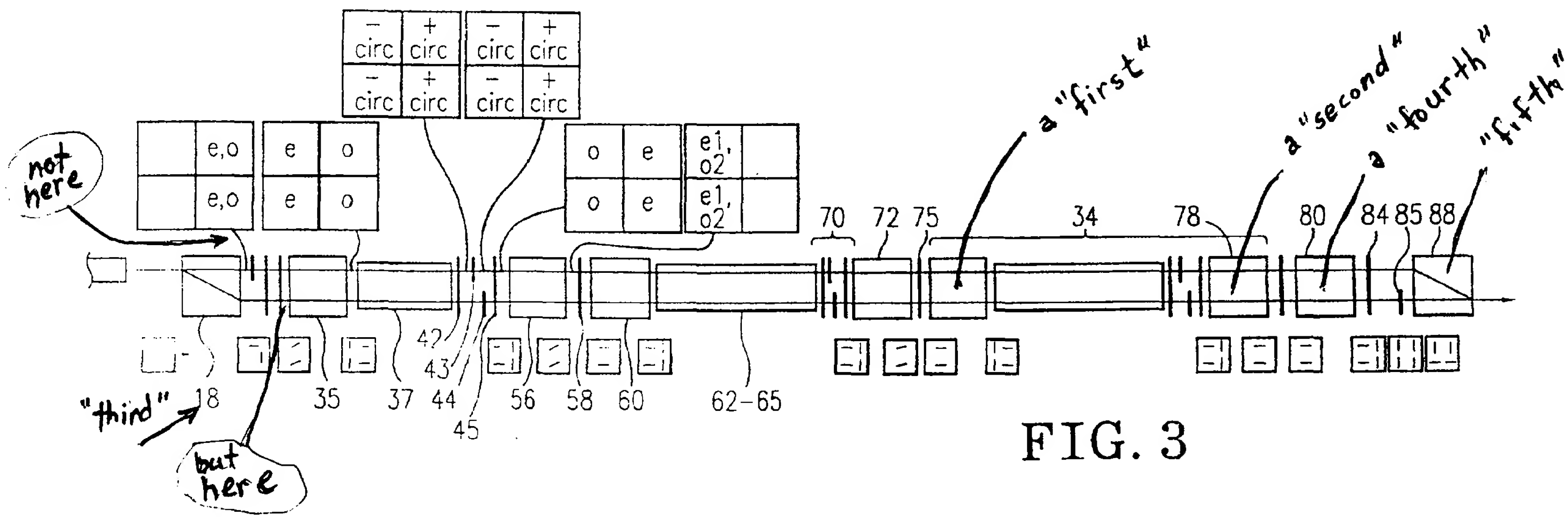

not here
e,o
e,o
e
o
e
o
– circ
+ circ
– circ
+ circ
– circ
+ circ
– circ
+ circ
o
e
o
e
e1, o2
e1, o2
a "first"
a "second"
a "fourth"
"fifth"
70
72
75
34
78
80
84
85
88
"third"
18
but here
35
37
42
43
44
45
56
58
60
62-65

FIG. 3

Claim Rejections – 35 U.S.C. § 112

Claims 10 and 20 - 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 10 is confusing or incorrect in the recitation of *each* of the stages providing a time delay difference which is an integer multiple of a selected value. When read in light of the specification, it is the difference in time delay between the two delay lines, measured at each stage which is an integer multiple of a selected value. That is, the stages cooperate *pairwise* to produce the recited "delay difference". It is believed that a recitation to the following effect more accurately describes the cooperation of elements (beginning in claim 10, line 7) " . . . the first and second optical delay lines each comprising a number of serial stages each providing an additional [a] time delay [difference] which is an integer multiple of a selected value, such that the time delays of each stage of the delay lines cooperate pairwise to provide a time delay difference which is an integer multiple of a selected value. . ."

Claim 20 is confusing or incorrect as to the cooperation of elements. Claims 21 – 23 inherit the same deficiency through their dependency from claim 20. It is believed that in the present embodiment, the function of the "first" beam splitter is actually applied to *two* input beams, rather than to "the input beam" as recited. In this respect, it is not the "third" beam splitter that produces the output beam pairs, but rather, the "first" beam splitter, in response to the "third" beam splitter. Applicants' use of the expression "beam pairs" in this respect is confusing or incorrect. It is believed that the claim should

read onto Figures 2 and 3, but the examiner is having difficulty identifying which of the beam splitters correspond to the recited elements. A number of stages are presented in the Figures, and the examiner finds it less confusing to read the remaining claimed structure on the last delay stage and output stage, as shown in the attached marked-up figures. The claim language proposed below is not purported to distinguish over the prior art, but rather to convey the examiner's understanding of the embodiment.

Claim 20 (Proposed) A microoptic element with synthetic birefringence for modifying the transmission characteristics of an input optical beam comprising :

first and second polarization beam splitter devices, wherein the first polarization beam splitter device separates [the] an input beam into first and second orthogonally polarized outputs [output beams] along first and second [beam] paths[,] ;

a first non-birefringent optical delay line in the first [beam] path arranged such that the first output [beam] undergoes a first time delay[,] ;

a second non-birefringent optical delay line in the second [beam] path arranged such that the second output [beam] undergoes a second time delay, different from the first, with the time delay difference being precisely determined by optical path length difference between the optical delay lines, [and]

the second polarization beam splitter device being arranged to recombine the first and second delayed outputs [beams] into a single output [beam] having interfering components defining the desired modification in transmission characteristics, the element also including

third, fourth [forth] and fifth polarization beam splitter elements,

the third polarization beam splitter being disposed before the first to split an upstream [the first] input beam into upper and lower orthogonally polarized beams [beam pairs for differential delays], such that the first polarization beam splitter device separates the upper and lower beams into said first and second orthogonally polarized outputs as a first beam pair of a first polarization and a second beam pair of a second, orthogonal polarization for differential delay between the pairs traveling along the first and second beam paths respectively,

wherein the fourth polarization beam splitter device receives the two outputs from the second polarization beam splitter [beam pairs] after differential delay to provide two pairs of [wavelength dependent intensity modulated] beams, the polarization of the first pair being orthogonal to the polarization of the second pair, each pair having an intensity varying differently with wavelength, [of orthogonal polarization] and

the fifth polarization beam splitter device is disposed after the fourth [forth] polarization beam splitter to combine the power of [the pairs] each pair [of orthogonally polarized,] into a respective one of two intensity modulated beams.

Suggested claim language:

Claim 20 (Proposed) A microoptic element with synthetic birefringence for modifying the transmission characteristics of an input optical beam comprising :

first and second polarization beam splitter devices, wherein the first polarization beam splitter device separates an input [the input beam] into first and second orthogonally polarized outputs [output beams] along first and second beam paths[,] ;

a first non-birefringent optical delay line in the first beam path arranged such that the first output [beam] undergoes a first time delay[,] ;

a second non-birefringent optical delay line in the second beam path arranged such that the second output [beam] undergoes a second time delay, different from the first, with the time delay difference being precisely determined by optical path length difference between the optical delay lines, [and]

the second polarization beam splitter device being arranged to recombine the first and second delayed outputs [beams] into [a single beam] two beams each having interfering components defining the desired modification in transmission characteristics, the element also including

third, fourth [forth] and fifth polarization beam splitter elements,

the third polarization beam splitter being disposed before the first to split an upstream [the first] input beam into upper and lower orthogonally polarized beams [beam pairs for differential delays], each of the upper and lower beams having two orthogonally polarized components such that the first polarization beam splitter device separates the upper and lower beams into said first and second orthogonally polarized outputs as a first beam pair of a first polarization and a second beam pair of a second, orthogonal polarization for differential delay between the pairs traveling along the first and second beam paths respectively,

wherein the fourth polarization beam splitter device receives the two beams [beam pairs] after differential delay to provide two pairs of [wavelength dependent intensity modulated] beams, the polarization of the first pair being orthogonal to the polarization of the second pair, each pair having an intensity varying differently with wavelength, [of orthogonal polarization] and

the fifth polarization beam splitter device is disposed after the fourth [forth] polarization beam splitter to combine the power of [the pairs] each pair [of orthogonally polarized,] into a respective one of two intensity modulated beams.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 20, 24, 25, 29, 31, 42, 43, and 46 – 50 are rejected under 35 U.S.C. 102(e) as being anticipated by Zhao (U.S. Patent Application Pub. no. 2002/0048424 A1). Referring *for example* to the discussion of Figures 5 and 6, Zhao discloses first (14a), second (14c), third (10), fourth (12), fifth (13) polarizing beam splitters, the first and third beam splitter cooperating to divide an input beam into upper and lower orthogonally polarized beam pairs, as shown in the attached marked-up copy

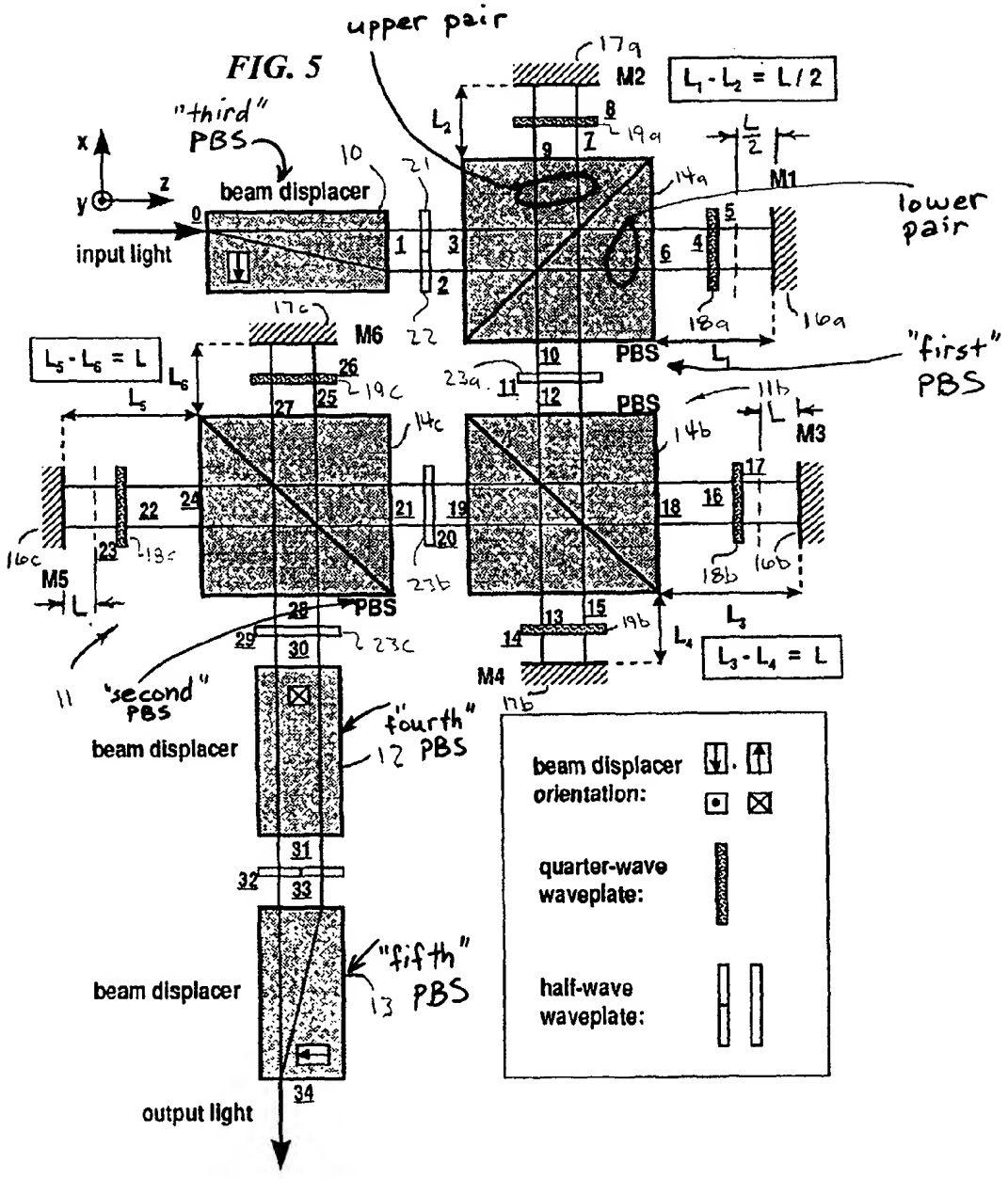
of Figure 5. The assembly comprises a number of stages wherein the path length differences are integer multiples (1, 2, and 2) of the same value, L. Waveplates (23a) and (23b) are provided between stages to tailor the response. The characterization of the apparatus as "a microoptic element" is not seen as imparting any positive structural characteristic as would distinguish over the prior art, which has all of the positive recited structure. The provision of athermalized paths is discussed in paragraph [0075].

With regard to claim 24, Zhao fairly conveys that the interleaving apparatus is operated as a demultiplexer (para. [0033]) separating the even channels from the odd channels (para. [0009]). One skilled in the art of dense wavelength division multiplexing would understand this to mean that the output sets are spaced having twice the periodic frequency spacing, with the frequencies being in alternating relation. The two outputs are shown in frame 34 of Figure 6 as an "a" set and a "b" set. Zhao discusses the use of a glass delay element and air segments in paragraph [0075].

With regard to claim 29, it is believed that the illustration of the "beam displacer"(10) as having an "orientation" and as walking-off the polarization components fairly conveys that the "ordinary" and "extraordinary" components are separated. The function of waveplates (21), (22), (23a), and (23b) is analogous to setting the crystal axis orientations in a multistage birefringent crystal filter. That function corresponds to phase tuning.

With regard to claim 43, Zhao discloses that materials having a desired index of refraction may be inserted into any of the paths, and that the paths may have the same physical lengths (para. [0075]).

FIG. 5


upper pair
"third" PBS
beam displacer
input light
M2
M1
lower pair
M6
M5
M3
M4
PBS
"first" PBS
"second" PBS
"fourth" PBS
"fifth" PBS
beam displacer
beam displacer
output light
$L_1 - L_2 = L/2$
$L_5 - L_6 = L$
$L_3 - L_4 = L$
beam displacer orientation:
quarter-wave waveplate:
half-wave waveplate:

With regard to claim 47, waveplates (21)(22) form input polarization management optics, as shown in frame 3 of Figure 6. Output polarization management optics are provided between the fourth an fifth polarization beam splitters, serving the function shown in frames 31 – 33 of Figure 6.

With regard to claim 48, a first beam splitter combination (10) having the recited function is provided. Beam splitter (14c) performs the function recited for the second beam splitter combination, while beam splitters (12) and (13) perform the function of the recited third beam splitter combination. The characterization of the intermediate stages as "microoptic" elements is not seen as imparting any positive structural limitation as would distinguish over the prior art.

Claims 10, 18 – 20, 42, 46, 47, 58, and 64 are rejected under 35 U.S.C. 102(e) as being anticipated by Ducellier (U.S. Patent number 6,570,711). Referring *for example* to Figure 4 and the associated text (wherein the components are labeled similarly to those in Fig. 3), Ducellier discloses a first polarization beam splitting device (58), a first delay line including reflective surfaces (63) and (79) and a second delay line including reflective surfaces (69) and (83), the delay lines arranged in stages (48)(49) providing delay differences which are integer multiples of the same value (L, 2L). A half-wave plate (54) is oriented to provide 90° of polarization rotation.

With particular regard to claim 10, Ducellier describes the beams exiting the system for combination by the walk-off polarizers as being vertically horizontally polarized (Col. 5, lines 50 – 67). Thus, Ducellier fairly discloses the operation of the

walk-off polarizers as separating or combining vertically and horizontally polarized light. Thus, the artisan is to understand that the beams exiting beam splitter (53) are respectively horizontally and vertically polarized. One of the beams is incident on waveplate (54) to be rotated by 90°. Thus, the waveplate is *inherently* oriented at 45° with respect to the input polarization. Thus, the waveplate must be oriented at 45° with respect to either a vertical or horizontal polarization state. In either event, it must be within 45° of the vertical, as recited.

With regard to claims 18 and 19, Ducellier teaches that air gaps may be provided in each delay line (as in Figure 2) and that shear plates may further be included for fine adjustment of path length variations (as in Figure 3). The examiner regards these as non-birefringent delay "elements" within the meaning of the instant specification. Further, Ducellier teaches that stages can be arranged into the two-pass system of Figure 3, in which the quarter-wave plates in each delay line rotate the state of polarization (SOP) such that the SOP of even and odd channels is reversed between passes as a means to compensate for any dispersion present. The examiner thus regards the quarter-wave plates as functional equivalents of Applicants' means disclosed for this function.

With regard to claim 20, the beam splitters can be designated as first (58), second (74), third (53), fourth (104), and fifth (98), whereby they are associated with the respectively recited functions. As noted by the author, the device functions similarly to that of Figure 3, but the second set of beams cannot be seen in the plan view.

With regard to claim 42 and 46, the first beam splitter arrangement may be identified as comprising walk-off beam splitter (53) and beam splitting prism (58) which provide a beam pair advancing toward gap (66) with one polarization and a beam pair advancing toward reflective surface (63) with an orthogonal polarization. Beam splitting prism (74) may be regarded as the second beam splitter arrangement. The path length differences are harmonically related to approximate a flattened passband, which must be regarded as a "selected" characteristic.

With regard to claim 47, input waveplates (54) and (57) may be regarded as input polarization management optics; beam splitter (104), waveplates (97) and (101) and beam combiners (98) and (102) may be regarded as output polarization management optics.

With regard to claim 58, waveplate (54) fairly constitutes a waveplate "array", which beam splitter (105) fairly constitutes "fold" optics. Polarization rotating optics (73) and (96) are provided between stages to adjust the optical characteristic. GRIN lens (52) is described as an input collimator; GRIN lenses (99) and (103) are described as output focusing lenses. Insofar as the interleaver of Ducellier is disclosed as a "virtual waveplate" interleaver, and insofar as interleavers are disclosed for use as optical multiplexers for WDM channels carried over fiber (Col. 1, lines 18 – 30), it is believed that one of ordinary skill would understand the function of the GRIN lenses of Ducellier as being fiber collimators, as recited.

With regard to claim 64, Ducellier teaches that stages can be arranged into the two-pass system of Figure 3, in which the quarter-wave plates in each delay line rotate

the state of polarization (SOP) such that the SOP of even and odd channels is reversed between passes as a means to compensate for any dispersion present. It will be appreciated that in such an arrangement, all of the effective paths lengths are equal, and there is substantially zero PMD.

Claim Rejections - 35 USC § 103

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao (US 2002/0048424 A1), in view of Official notice. As set forth above for claim 24, Zhao discloses the invention substantially as claimed, including air length segments and athermalized performance. Further, Zhao teaches endeavors to achieve dense wavelength division multiplexing interleaved channel spacings of 100 GHz, 50 GHz, 25 GHz, and even 12.5 GHz (paras. [0009] – [0011]). However, Zhao does not expressly disclose the spaced channels as lying on a selected ITU grid, as recited.

The examiner takes Official notice that 200 GHz, 100 GHz, 50GHz, 25 Ghz, and 12.5 GHz were all known frequency spacings available on the ITU grid.

It would have been obvious to one of ordinary skill to arrange the spaced channels of Zhao on a selected ITU grid, in the interest of providing an interleaver having utility in known communications networks. One of ordinary skill would have recognized the rather obvious advantage of improved marketability and sales attendant a product that is compatible with systems already widely in use.

Claims 60 – 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ducellier, in view of Official notice. As set forth above for claim 58, Ducellier discloses the invention substantially as claimed. Further, Ducellier discloses the interleaver for use in ITU networks (Col. 6, line 55). However, Ducellier does not disclose the particular path length differences or frequency spacing recited.

The examiner takes Official notice that 200 GHz, 100 GHz, 50GHz, 25 Ghz, and 12.5 GHz were all known frequency spacings available on the ITU grid.

It would have been obvious to one of ordinary skill to set the path length differences of Ducellier to provide a 12.5 GHz, 25 GHz, 50 GHz, or 100 GHz interleaver, in the interest of providing an interleaver useful in networks operating with any of these known frequency spacings. With particular regard to the associated path length differences, Ducellier teaches that the path length differences are selected in accordance with the desired frequency spacing (Col. 4, lines 25 – 30). Thus, barring any *unexpectedly* improved result, it appears that one ordinary skill would have arrived at the recited path length differences through routine manipulation of this result effective variable. *In re Antonie,* 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also *in re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In the instant case,

Allowable Subject Matter

The previous indication of claims 18, 20, 24, 42, 48, and 58 as containing subject matter allowable over the prior art is withdrawn, in light of a new understanding of the invention as claimed, and in light of a better understanding of the prior art to Zhao '424,

and in light of newly discovered prior art to Ducellier. The examiner regrets the delay in applying the prior art in this manner and apologizes for any inconvenience.

Claims 1, 2, 4, 5, 7, 13 – 16, 34, 36 – 41, 65, and 67 – 70 are allowable over the prior art. Claims 27, 28, 30, 32, 33, 44, 45, 51 – 57, and 59 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 21 - 23 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The prior art, taken alone or in combination, fails to teach or to fairly suggest *in combination,*

half-wave plates *and* quarter-wave plates *positionable at angles* for tuning, as recited in claim 1 [although Ducellier discloses quarter-wave plates, they are not positionable at angles for tuning];

a phase shift tuning structure in *both* the first and second beam paths, comprising, in addition to the rotatable half-wave plate and second quarter- or three-quarter waveplate, a first quarter- or three-quarter wave plate oriented at 45°, as recited in claim 13 [although both Zhao and Ducellier disclose oriented half-wave plates and quarter waveplates oriented at 45°, there is no combination of these elements in *both* the first and second beam paths];

wavelength tuning elements in the beam paths associated with the delay lines, as recited in claim 21;

a polarization beam splitter angled to adjust the frequency period, as recited in claims 23 and 30 (Zhao and Ducellier adjust periodicity with path length differences];

the use of plural glasses of differing refractive indices, as recited in claims 27 and 55 [Ducellier teaches away from glass; Zhao apparently suggests a single glass use with air gaps];

the use of a pair of glass elements in one path, and a single glass element in the other path, as recited in claim 28;

the close loop reflecting path recited in claim 32;

the waveplate frequency adjusting means *receiving circularly polarized signals* as recited in claim 33;

glass elements of substantially equal lengths with index differences greater than 15%, as recited in claim 34;

glass elements in different paths having like path length changes with temperature, as recited in claim 44;

orthogonally polarized components *received by the microoptic elements* as circularly polarized light, as recited in claim 51;

half-wave plates means *in the path of circular polarization* as recited in claim 53;

the input waveplate array oriented to minimize PMD by balancing optical path lengths, as recited in claim 59; or

each stage comprising a waveplate combination for *tuning selected channel placements,* as recited in claim 65.

Response to Amendment

Applicants' amendment is sufficient in overcoming the previous objection to claims 58 – 64 for a lack of antecedent basis, and the rejection of claims 1 – 23 and 68 – 70 under 35 U.S.C. § 112, second paragraph for various deficiencies.

Applicants' amendment of claims 1, 14, and 16 is sufficient in overcoming their previous rejection under 35 U.S.C. §102(b) as being anticipated by Cimini, Jr.

Applicants' amendment of claims 1, 10, 14, 16, and 65 is sufficient in overcoming their previous rejection under §102(e) as being anticipated by Zhao (U.S. 2002/0048424 A1). The cancellation of claims 11 and 12 obviates their rejection on these grounds. Applicants' remarks concerning the rejection of claim 10 under 35 U.S.C. §102(e) as being anticipated by Zhao '424 have been considered to the following effect. Applicants remark that there appears to be no basis for the examiner's previous position that "delays are provided as integer multiples of the same delay, Γ". The examiner believed that Applicants would recognize that the Solc filters discussed in paragraphs [0067] & [0068] of Zhao '424 by definition employ crystals of equal phase delays (see E.O. Ammann, cited below). In such simulations, the stages have delays all equal to unity times the same delay, Γ. In the embodiment discussed in paragraph [0079], two stages are provided with respective delays, Γ, and 2Γ. In the embodiment discussed in paragraph [0081], three stages are provided with respective delays of Γ, 2Γ, and 2Γ.

The discussion spanning paragraphs [0067] – [0071] should make it clear that Zhao '424 manipulates both the phase delays and relative waveplate angles to simulate any number of birefringent crystals of integer multiple lengths and diverse angular orientation. One skilled in the art of birefringent filter synthesis would appreciate that Zhao '424 indeed discloses all of the structure necessary to tailor the transmission, dispersion, and phase distortion of the filter. In such an all-pass design, it should be appreciated that this flexibility is all that is required to "provide periodicity or phase variations such as to achieved [*sic*] flattened bandpass characteristics, or effect other types of transfer function modifications." All of that notwithstanding, the half-wave plates of Zhao preceding the first stage are specifically selected with angular orientations of +22.5° and –22.5° in order that the first stage simulates a birefringent crystal oriented at 45°. The examiner finds no suggestion to orient one or both waveplates at 45° as now recited in claim 10. The examiner believes that in accordance with the teachings of Zhao' 248, such an orientation would have been equivalent to a waveplate oriented at 90°. In the examiner's understanding a 90° first stage crystal orientation leads to a trivial result and has no utility in birefringent filters. As such, it seems that modification of the reference in this manner would have disrupted the intended operation. Accordingly, the aforementioned recitation is sufficient to distinguish over Zhao '424.

Applicants' amendment of claims 14 and 16 to depend from claim 13 is sufficient in overcoming their previous rejection under §102(e) as being anticipated by Zhao '424,

since the reference does not disclose the recited arrangement of phase shift tuning structures comprising a half-wave plate and quarter-wave or three-quarter wave plates.

The amendment of claim 65 distinguishes over Zhao '424 at least for the reasons set forth in the last Office action with respect to claim 66.

Applicants' amendment of claim 34 is sufficient in overcoming the rejection of claims 34 – 39 under §103(a) as being obvious over Zhao '424. Claim 7 depends from claim 1, and distinguishes for the reasons previously discussed. Claims 68 – 70 are allowable for the reasons set forth for parent claim 65. Although Zhao teaches that the physical path lengths may be the same (para. [0075]), the suggestion appears to be that of a length of air would be in the first path and a length of a more refractive material would be in the second path. Even assuming one were motivated to employ identical lengths of glass having different refractive indices, the following factors must be considered. Zhao teaches that the path length differential emulates a birefringent crystal. Although the values vary significantly with wavelength and temperature, the examiner believes the following values for some well-known birefringent crystals are fairly illustrative for use near wavelengths on the ITU grid:

crystal	n_e	n_o	Δn	% variation w.r.t. lower index
YVO4 (@1550nm)	2.1486	1.9447	.2039	10.5
Rutile (@1530 nm)	2.709	2.451	.258	10.5
Calcite (@1500 nm)	1.477	1.635	-0.158	10.7
LiNbO3 (@1440 nm)	2.141	2.215	-0.074	3.46

Thus it appears that in order to truly emulate a segment of birefringent crystal, the glasses of equal length would have to have refractive indices varying by less than 11%, rather than by more than 15%, as now recited.

The rejection of claims 2 – 6, 15, and 17 – 19 under §103(a) as being upatentable over Zhao '424 in view of Shirasaki (U.S. 5,982,488) has been overcome as set forth in Applicants' remarks.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Zhao (U.S. Patent Application Pub. no 2001/0053024 A1) discloses an optical interleaver comprising an interferometric arrangement for simulating birefringence.

Although not prior art with respect to Applicants' domestic priority date under §119(e), Su, et al (U.S. Patent Application Pub. no. 2003/0099013 A1) disclose an optical interleaver comprising a plurality of delay stages that simulate birefringence. Wang, et al (U.S. Patent number 6,545,782) corresponds to the parent application of Su, et al but lacks an enabling disclosure of the simulated birefringent arrangement.

Although not prior art with respect to Applicants' domestic priority date under §119(e), Zhou, et al (U.S. Patent number 6,498,680) disclose an optical interleaver with an interferometric arrangement for providing phase shifts.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Juba whose telephone number is (703) 308-4812. The examiner can normally be reached on Mon.-Fri. 9 - 5.

On or about January 20, 2004, the examiner's new phone number is expected to be (571) 272-2314 at the Alexandria campus.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Drew Dunn can be reached on Mon.- Thu., 9 - 5.

The centralized fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for *all* communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JOHN JUBA
PRIMARY EXAMINER
Art Unit 2872

November 21, 2003